SOME OBSERVATIONS ON NESTING HABITS AND BIOLOGY OF *VARANUS SALVATOR* (LAURENTI) OF BHITARKANIKA SANCTUARY, ORISSA[1]

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(*With a plate & two text-figures*)

INTRODUCTION

So far little is known about the nesting habits and biology of *Varanus salvator* (Laurenti) which is mainly distributed in the coastal region of West Bengal and Orissa and also in Assam of Eastern India. However some observations have been made on the breeding and egg laying habits of the species in captivity in Madras Snake Park (1976 & 1978), Ahmedabad Zoo (1970) and Nandankanan Biological Park (1977). The present observation was carried out in the Bhitarkanika island situated in the Mahanadi Baitarani estuary of Orissa. Bhitarkanika, an area of 176 sq Km, has now been declared as a Crocodile sanctuary by the Orissa Government. Four nests with eggs of *Varanus salvator* were located within the sanctuary from an area of nearly 1 sq km adjacent to Dangmal village and four hatchlings of another species, *Varanus flavescens* (Gray) were also collected from the same area (Biswas & Kar 1979). The Water Monitor is now thriving well here, protected from exploitation by skin traders. It is presumed that mongoose is the predator of eggs of the monitor as they are common in this area.

This paper is a preliminary report on observations on the nesting habit and incubation experiment on the eggs of *V. salvator*. One clutch of freshly laid eggs was collected which did not hatch out but another clutch collected in an advanced stage of development, hatched out in the hatchery.

Selection of nest site: In Bhitarkanika *V. salvator* nests in the month of June during the wet season. The nesting places are always selected on high ground in secluded places. Bhitarkanika estuarine area is inundated by tide water twice daily and in the full-moon and new-moon the tide reaches its maximum. Therefore selection of nest site is made in such a way that even in maximum high tide, water does not reach the nest. Almost all the nests are seen placed in secure places free from human disturbance since there is no village situated on the island. All the villages are either close to or away from the river and its associated creek systems, which encircle the main Bhitarkanika island.

The most interesting observation in their selection of nesting site is that the monitor invariably selects a termite mound. The nesting mother selects one or two already existing holes of the mound and enlarges them into a cavity (Figs. 1 & 2). Though generally the nesting site is free from biotic interferences sometimes it may be situated close to human settlements inside the sanctuary. Selection of the nesting site is mainly guided and determined by the availability of termite mounds. The monitor prefers termite mound so much that it does not mind even if the

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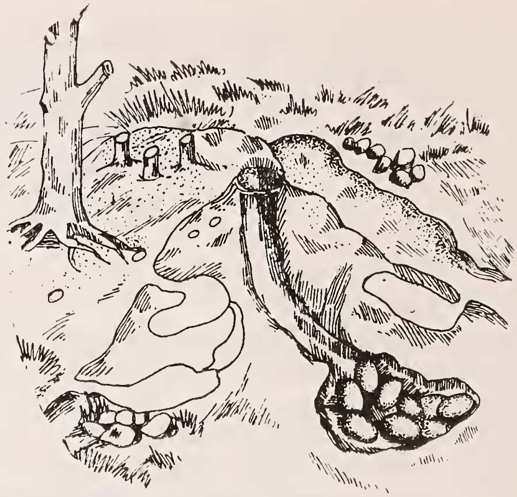


Left: Fig. 1. Diagram of a termitarium mound.
Right: Fig. 2. Diagram of the same dug up mound showing the location of eggs.

mound is close to the road or houses or in unused fields.

Nest hole or the cavity: The nest soil is mainly hard and loamy. The varanus selects a nest-hole in the slope of the termitarium at a high level from its base. In two nests measured the height from the base of the mound to the nest cavity is 9″ and 12″. The mother makes the hole wider and deeper by scraping soil from the mound by both fore and hind limbs and does not spend much energy for preparation of the nest. The shape of the nest is somewhat flask shaped, narrow neck with wide bottom (Figure 2). Four nests of *V. salvator* were examined (Table 1).

The nest nos. 1 and 4 are same. It is presumed that the same monitor utilised the nest for laying her eggs.

It appears from the Table 1 that the nest size depends on the size of the clutch.

Egg laying and its collection: Egg laying was observed on one occasion by a person who was working a few yards away from the nest (nest no. 1). On 24th June 1977 near about 7-30 A.M., a female varanus was seen on a way side termite mound scraping the soil with her limbs. After sometime she rested, with her head towards the top of the mound and the tail on the ground. The presence of the observer disturbed her and she left the nest site.

TABLE 1

No. of nests	Date	Nest size	No. of eggs	Nest temp. at the time of coll.	Air temp.	Time
1	24.6.77	30 × 21 cm	20	29.5°C	32°C	10 A.M.
2	25.2.78	22.5 × 17.5 cm	9	28.5°C	30°C	1 P.M.
3	18.6.78	20 × 19 cm	6	28.0°C	27°C	4 P.M.
4	19.6.78	27.5 × 17.5 cm	Nil	29.5°C	30°C	8 A.M.

When the site was examined, the nest hole was seen filled up with scraped up soil and it is possible that the varanus was observed when she was filling up the nest hole after laying the eggs.

Eggs were collected from three nests (nest nos. 1, 2 and 3) but the eggs of the 4th nest were found broken. The eggs of nest no. 2 were accidentally collected while some workers were clear felling an area and digging up a termite mound for soil. The nine eggs of this nest were in an advanced stage of development and hatched just eight days after they were placed for incubation. The embryos were already in a mature stage when three out of the 9 eggs were broken at the time of collection to ascertain the status of development of the embryo. One hatchling from these three eggs died immediately but the two other eggs were kept with the other incubating eggs.

Incubation: For incubation of the collected eggs an artificial nest mound of size, 45 × 30 cm was built with sand in the crocodile hatchery at Bhitarkanika and for recording temperature inside the nest a hollow bamboo pipe with a stopper on the top end of the pipe was inserted in the middle of the mound.

The incubation experiment on eggs of nest No. 1 was unsuccessful. After keeping the eggs inside the artificial nest for 43 days from 24.6.77 to 5.8.77 the nest was opened for inspection but it was found that eggs were all rotten and the shells were covered with fungal growth. The eggs of the 2nd nest required only eight days of incubation and no experiment was conducted on the eggs of the 3rd nest.

Incubation experiment on the eggs of nest No. 2 indicated that if the egg is an advanced stage is broken but the embryo of the broken egg case is not disturbed and incubation is continued, the hatchlings may survive.

The temperature record of the two clutches of eggs, Nest No. 1 (N-1) sterile and Nest No. 2 (N-2) consisting of eggs in advanced stage of development, placed for incubation in an artificial nest is given in Table 2.

TABLE 2

Clutch & Nest No.	Nest temp.			Range	Average
25°C	8°C	27.6°C	N-1	Minimum at 6 P.M.	
33°C				Maximum at 2 P.M.	
24°C	6.5°C	25.8°C	N-2	Minimum at 6 A.M.	
30°C				Maximum at 2 P.M.	

Weight and measurement of eggs:

The egg is elongated with both ends tapering bluntly and the shell is white, soft and leathery.

The measurement and weight of the three clutches of eggs, N-1, freshly laid but sterile, N-2, in advance stage of development and N-3, status unknown, is given in Table 3.

TABLE 3

Nest Nos.	N-1	N-2	N-3
Nos. of eggs	20	6	3
Range of length	68 to 79 mm.	68 to 76 mm.	64 to 77 mm.
Average of length	71.6 mm.	72.3 mm.	75.5 mm.
Range of breadth	38 to 41 mm.	44 to 47 mm.	35 to 38 mm.
Average of breadth	39.16 mm.	46 mm.	36.5 mm.
Range of weight	52.40 to 65.90 gm	77.50 to 87.20 gm	55 to 60.50 gm
Average of weight	58.24 gm	82.35 gm	58.87.gm

If the average breadth and weight (39.16 mm. and 58.24 gm) of the freshly laid eggs are compared with that of eggs of advanced stage of development (46 mm. and 82.35 gms.) then it may be presumed that the eggs of the 3rd clutch (36.5 mm. and 58.87 gms) were also freshly laid. The increase in egg size is more in width than in the length.

Hatching out of hatchlings out of the egg case: No indication was available of the time of emergence of the hatchlings except for the flow of the egg fluid when the hatchlings made slits on the egg case with their egg tooth. The fluid adhering to the thermometer inserted in the nest gave the indication that the hatchlings were ready to come out of the egg case. When the eggs were examined after opening the nest, 2 to 3, 2.5 to 5 cm long longitudinal slits or cracks on the egg shell were seen. These had been made by the sharply pointed egg tooth on the lip below the snout of the hatchling. After opening the nest on 5.3.78, the first batch of three hatchlings emerged from the egg shell. Two of the hatchlings still had chords but these became detached after 45 and 53 minutes and in one case after 2 hours of their emergence. The remaining 5 hatchlings emerged a day later.

Two slightly broken eggs were also kept for incubation along with the 6 other eggs. These two also hatched on 6.3.78 but the hatchlings were very inactive and their stomachs were swollen with chord attached with the egg membrane. It took 25 hours for freeing the chord from the egg cases.

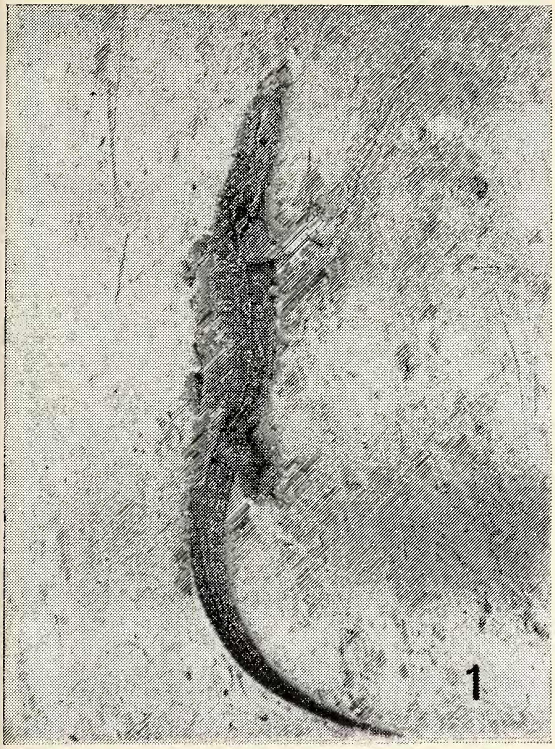
The hatchlings were very active immediately after hatching. One just after emergence went up a wooden pole of *c* 50 cm hight. If disturbed they hissed with swollen neck and raised head and during this moment the tongue would be seen darting out very frequently. All the hatchlings excepting two were very active and immediately after coming out of the egg shell they started moving about the hatchery and climbing on its poles and wire netting.

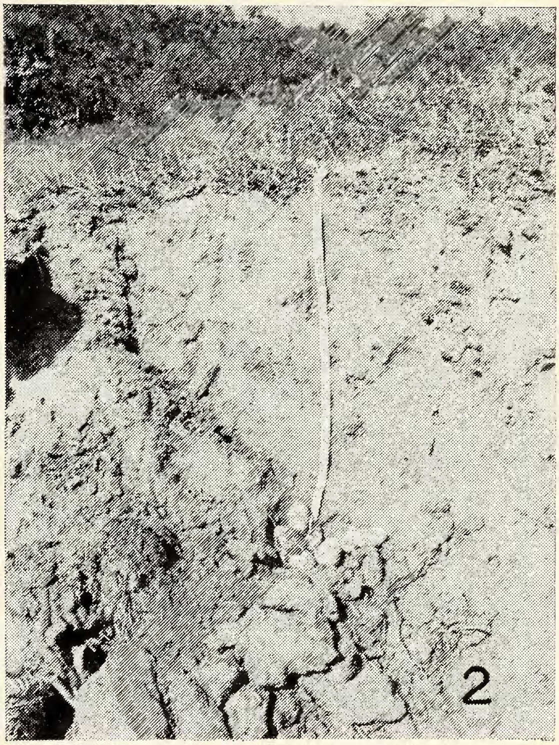
In colour, the hatchlings were very black with yellow spots arranged dorsally in transverse rows.

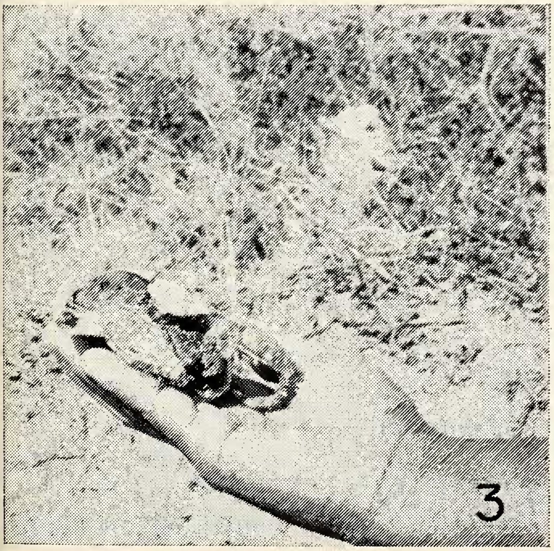
Parental care: Though parental care in varanus was not studied in detail, observations on the mother varanus were continued after collecting her eggs from the nest on 24.6.77. She was found on the same night, on the nest for nearly about one hour scraping soil to fill up the opened but empty nest hole. On the morning of 25.6.77 she was again seen near the nest, disappeared immediately on seeing the observer. This varanus was kept under regular observation upto 2.7.77. Mostly in the evenings it was seen in a hole close to the nest, with the snout protruding from the hole. But on 3.7.77 it was disturbed during the day by village boys and from that day onwards she was not seen coming near her nest.

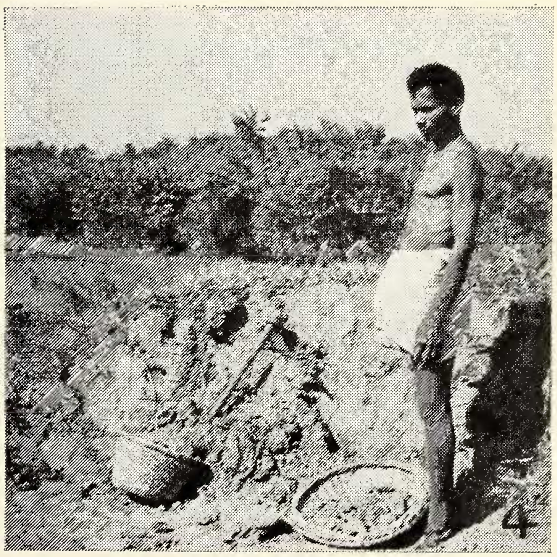
The observations on the mother varanus could not be completed to decide whether she takes special interest in opening the nest to help the hatchlings to emerge. But it has been observed in the case of artificially incubated eggs that the hatchlings produced no noise inside the nest as is produced by hatchlings of crocodiles. Therefore, it is presumed that there is no parental assistance for opening the nest. The nature of the soil of the selected nest site in termitarium, particularly from the soil used by the mother to close the nest it can be deduced that there is no necessity for help for the hatchling to come out of its nest. The closed nest not being compact, it is very easy for the active and agile hatchling to come out of the nest without the mother's help.

It will appear from the table that in the hatchling there is an approximate equal proportion between total length of the body to the weight and the tail to snout vent proportion which is nearly 1.5.









Varanus salvator (Laurenti)
Fig. 1. View of an adult female.
Fig. 2. Dug out egg nest in a termitarium showing actual position of eggs with a measuring tape. Fig. 3. Showing just hatched out hatchling. Fig. 4. Showing a view of partially dug out nest in the natural surroundings.